



FBI LABORATORY

DNA CASEWORK UNIT (DCU)



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DCU MISSION

To provide forensic DNA examinations to the FBI and other duly constituted law enforcement agencies in support of criminal, missing persons, and intelligence cases through evidence testing using forensic serological, mitochondrial DNA, and nuclear DNA methodologies



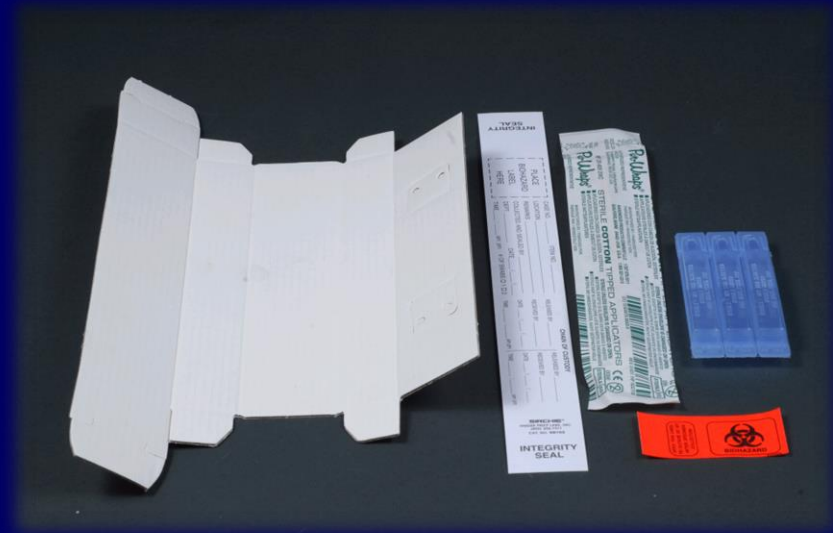
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CASE ACCEPTANCE

To find out details about submitting evidence and to determine if a case meets the DCU Acceptance Policy please visit <http://www.fbi.gov/about-us/lab/biometric-analysis/dcu-case-acceptance-guidance-final.pdf>

COLLECTING DNA Evidence in the Field

- Send in entire item or cutting if possible
- Use a swab moistened with sterile water for collection
- Visible collections (body fluid)
 - Collect entire stain onto swab
 - Do not send test swabs
- Non-visible collections (DNA)
 - Swab entire area of interest using **as few swabs as possible**
- Allow swabs to dry **completely**



EVIDENTIARY ITEMS

- Collect from textured areas mostly likely to contain DNA
- Avoid smooth surface areas for fingerprint preservation
- Collect DNA onto a minimum number of swabs



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OTHER CONSIDERATIONS FOR EVIDENTIARY ITEMS

- Evidence handled in the public domain (e.g. door knobs at public buildings, bank pens, counter-tops, etc.) are generally not eligible for DNA databases and should not be submitted without calling the FBI DCU to discuss



- Low-level DNA evidence – “touch DNA” has significant limitations and should not be submitted without calling the FBI DCU

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EVIDENCE PACKAGING

- Take precautions to preserve the evidence
- Package and properly seal each item separately
- Permit wet sample to dry prior to packaging
- Place evidence in an appropriate inner container
- Completely seal outer container so that tampering would be evident



How You MAY AFFECT RESULTS

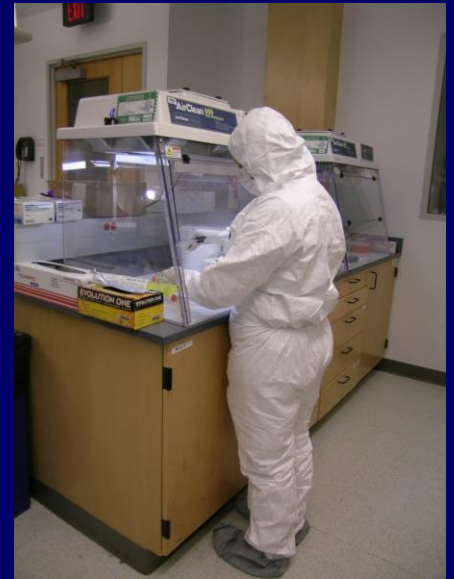
- Remember: contamination can mask true DNA profile
- Avoid sneezing, coughing and touching yourself with gloved hands
- Change gloves between handling of different items of evidence and between different areas of the scene
- Package evidence separately to prevent transfer and cross-contamination between items
- Always air-dry wet evidence prior to sealing
- Send elimination sample if there is suspicion of contamination



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EVIDENCE

- Where your evidence goes once it has arrived at the Laboratory will depend on:
 - Which type of examination(s) you request
 - The details you provide to the Laboratory
 - More detail may make it is easier to determine what exams are needed
 - Evidence Intake
 - Incoming case documentation will be reviewed and the evidence will be distributed to the appropriate units to begin examinations



COMMUNICATION IS KEY!

PRESUMPTIVE TESTING AT THE SCENE

- Never use luminol or flourescein when blood is visible
- luminol or flourescein may dilute the DNA and could prevent it from being detected in the lab
- Let us know when you use flourescein on evidence
- Even if you perform serology testing in the field we **must** do our own at the lab
- If performing tests in the field remember DNA!
 - Beware of contamination & the amount of sample you might consume






TYPES OF EVIDENCE THAT **MAY** BE SUITABLE FOR DNA TESTING



General Body:

- Vaginal swabs
- Oral swabs
- Rectal swabs
- Baseball cap/hat
- Eyeglasses
- Fingernails
- Worn clothing
- Bandages 
- Hair brush
- Condoms
- Body tissue
- Hair

Mouth:

- Licked stamps 
- Licked envelopes
- Cans/bottles/cups
- Chewing gum
- Phone receivers
- Bite marks 
- Ski mask
- Straw
- Toothbrush
- Utensils 
- Cigarette butts
- Spit

Hands

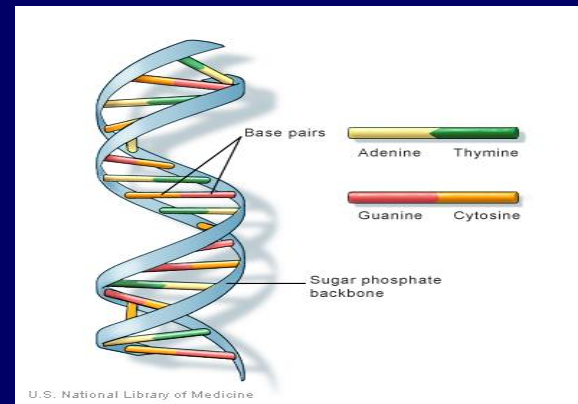
- Weapon handle
- Gloves 
- Handguns
- Shotguns/rifles
- Steering wheel
- Arm/headrest
- Fingerprint
- Palm print
- Hammer
- Keys
- Pen
- Tools 

WHAT ARE THE TYPES OF EXAMINATIONS PERFORMED IN DCU?

- Serological Testing

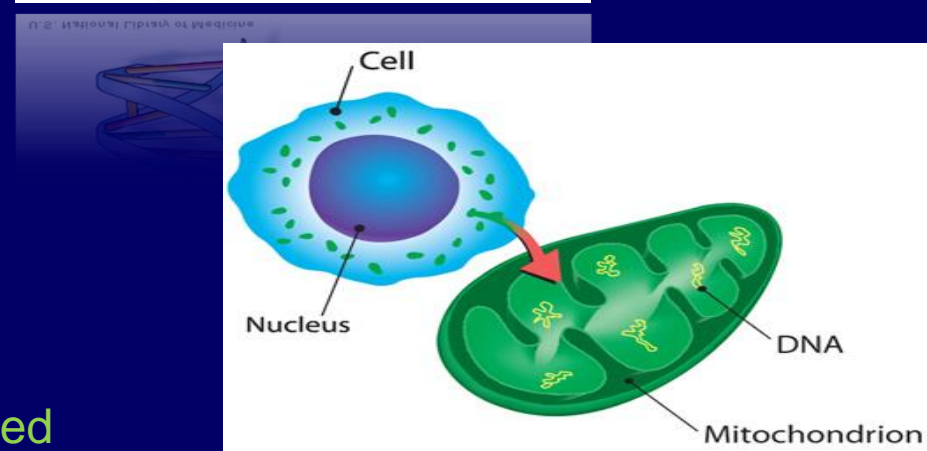


- Nuclear DNA Testing



- Y-chromosome DNA Testing

- Mitochondrial DNA Testing



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FORENSIC SEROLOGY

- DCU tests for the presence of:
 - Blood
 - Semen
- Serology can detect even non-visible stains for DNA testing
- Body fluid identification can corroborate case scenario and aid investigations



WHY PERFORM DNA TESTING?

- Identify a specific person as the source of the DNA
- Eliminate specific person as the source of the DNA
- Link the victim or suspect to a crime scene
- Link the suspect to the victim

WHAT IS DNA- DeoxyriboNucleic Acid

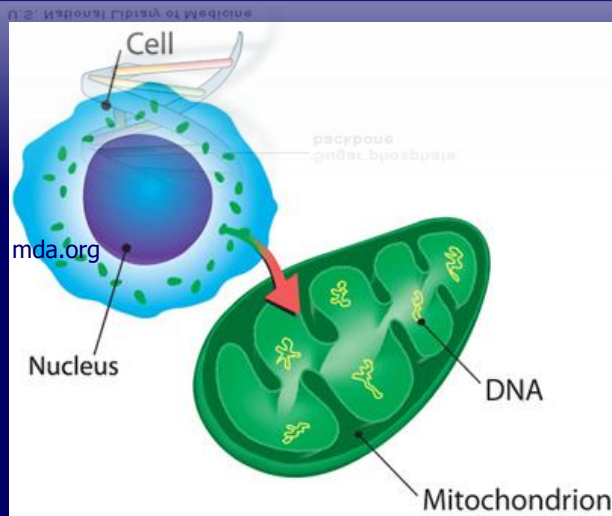
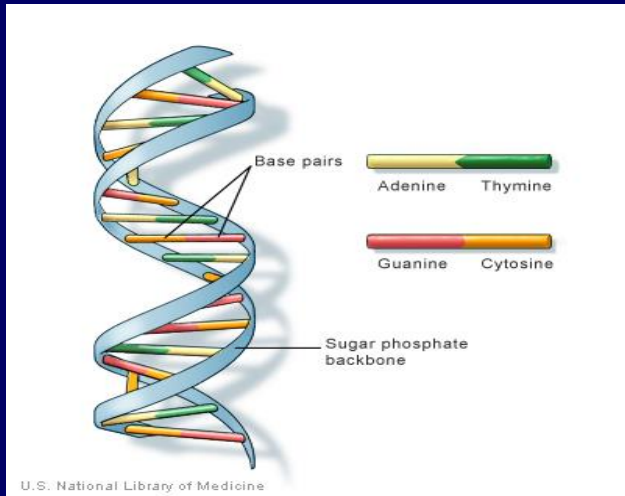
Two Types of DNA Testing Are:

Nuclear DNA

- From both parents
- 2 copies per cell
- Unique to an individual
- Most common type of DNA testing

Mitochondria

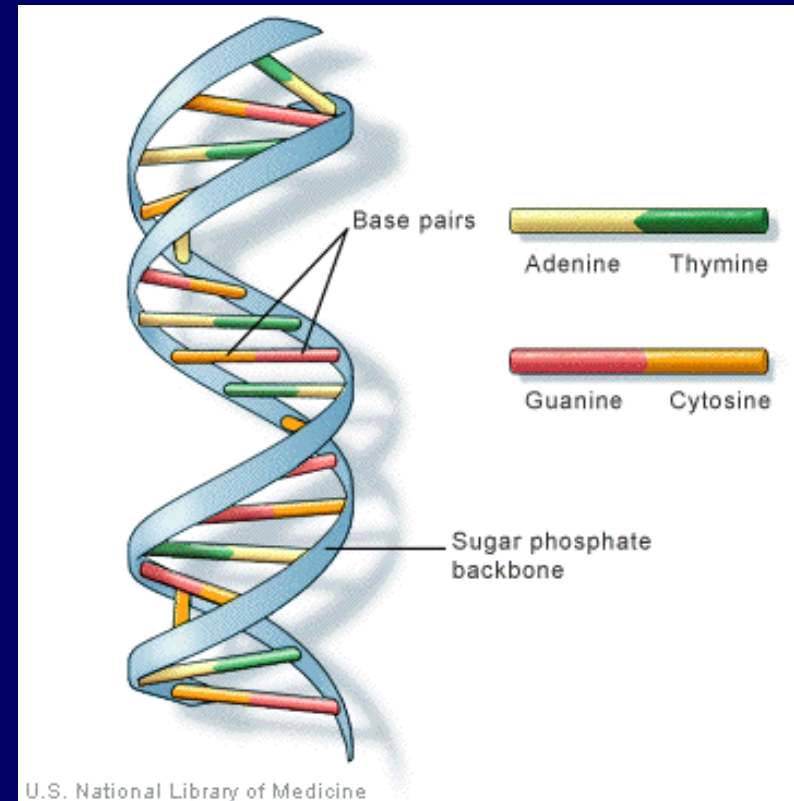
- Maternal inheritance
- 100-1000 copies per cell
- Shared among all maternal relatives
- Excellent for bone/teeth/hair evidence



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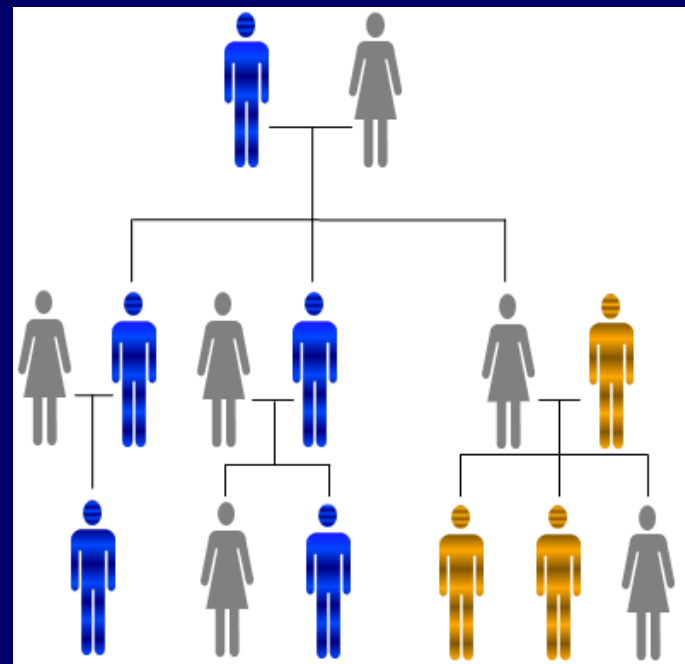
NUCLEAR DNA ANALYSIS

- Nuclear DNA analysis requires a limited amount of biological material and can be an excellent tool for forensic investigations
- Involves performing Short Tandem Repeat (STR) testing on regions of DNA where a short sequence is repeated in tandem
- The number of repeats at a particular STR location varies between people
- Performing STR testing at multiple locations in the DNA provides for a high degree of discrimination between samples



Y-CHROMOSOME ANALYSIS

- Primary value is that Y-chromosome found only in males
- Designed to only examine the male specific portion of DNA evidence
- Good for sexual assault cases with high levels of female DNA
- Useful when conventional nuclear test results are limited; but can not distinguish between paternal relatives and discrimination power is not as high as STRs



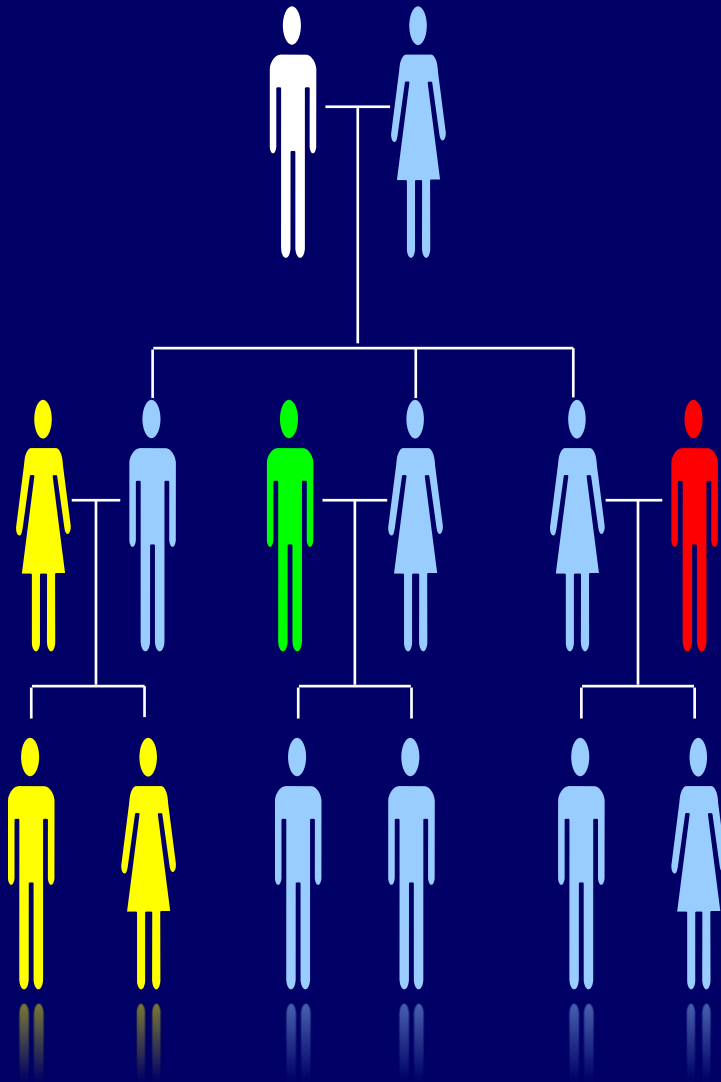
MITOCHONDRIAL DNA ANALYSIS

- Mitochondrial DNA (mtDNA) is used on hair, bones and teeth
- The most common type of biological evidence found at crime scenes are naturally shed hairs, which typically do not have enough nuclear DNA for analysis
- MtDNA is not unique to an individual; it is shared between maternal relatives
- The National Missing Persons DNA Database began in 2000 and uses DNA testing to help identify skeletal remains



MITOCHONDRIAL DNA ANALYSIS

- Good for examination of samples with low levels of DNA (e.g. shed hair, limited bones or teeth)
- Extends the number of possible reference samples (e.g. missing persons, kinship analysis)
- Cannot be used to uniquely identify an individual; all maternal relatives share a common mtDNA type
- Power of discrimination not as high as STR testing



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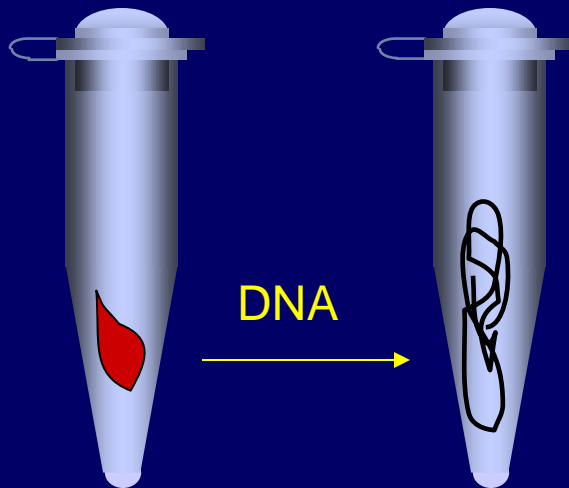
EVIDENTIARY ITEMS ARE CUT OR SWABBED FOR DNA TESTING



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DNA IS EXTRACTED

- Chemicals added to sample containing DNA
- DNA is extracted & isolated from the substrate



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AMOUNT OF DNA IS DETERMINED

- Quantify how much DNA is present in our sample extract
- Specific amount of DNA is desired for obtaining results



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DNA IS AMPLIFIED

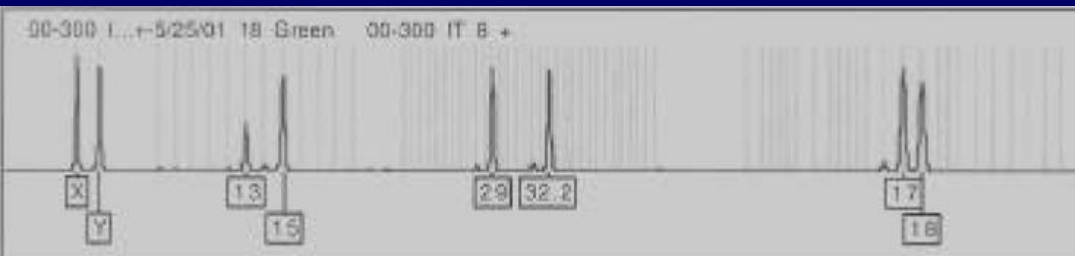
- Multiple copies of **STR regions** of the DNA are made through the Polymerase Chain Reaction (**PCR**)
- Copies are then visualized on instrument that separates DNA based on **size**



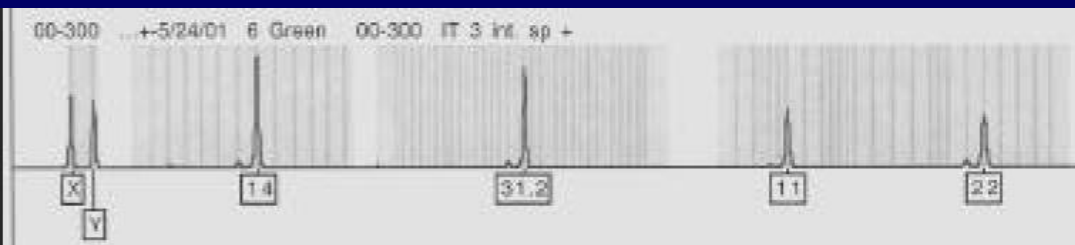
Perform Comparison



Evidence



Suspect # 1-
no match



Suspect # 2- is
a match

IF A MATCH OCCURS BETWEEN EVIDENCE SAMPLE AND A
REFERENCE SAMPLE – A STATISTICAL CALCULATION IS
PERFORMED TO DETERMINE THE RARITY OF THE MATCH

HOW LONG WILL THE EXAMINATION TAKE?

- DCU eliminated its nuclear DNA backlog in 2012 and its mitoDNA backlog was eliminated in 2014
- Average Turn-Around-Time: approximately 30 days
- Priority of case is based on investigative status
 - High profile
 - Judicial deadline/ “speedy trial”
 - Information for arrest/search warrant
- Complexity of case affects time of examination
 - Cases with a large number items are the most time consuming
- Amount of serological screening
- Quantity of items submitted



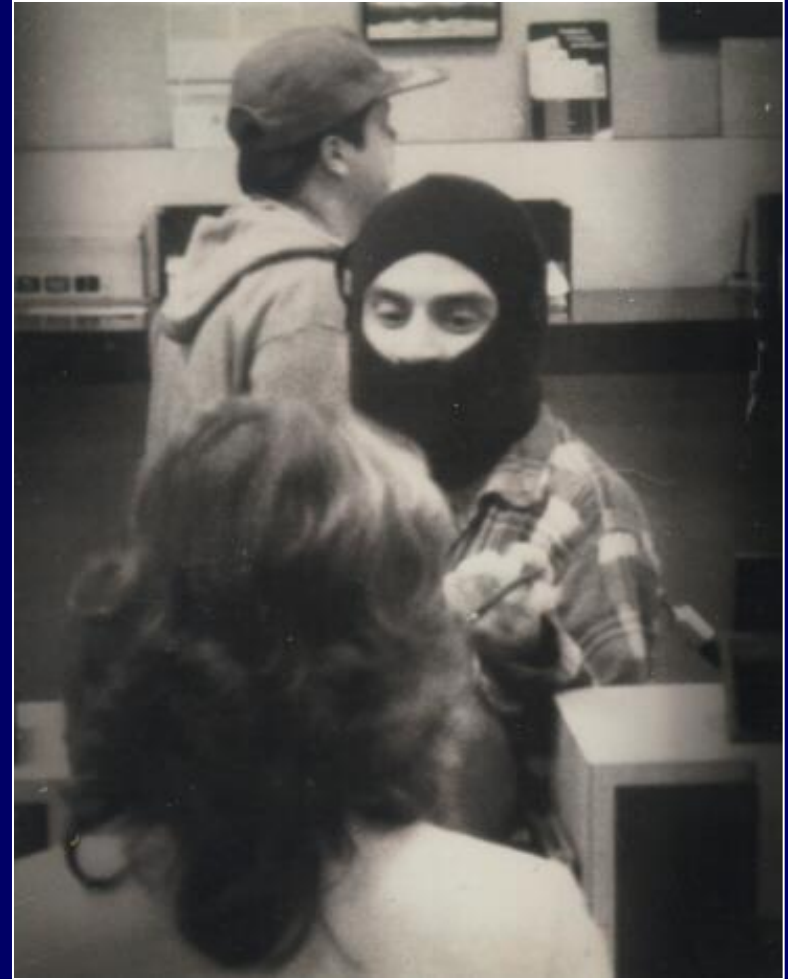
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HOW CAN YOU SPEED UP THE PROCESS?

- Provide us with as much relevant information as possible on incoming documentation
- Provide us with documentation permitting sample consumption
- Submit **reference** samples
 - Victim(s)
 - Suspect(s)
 - Elimination(s)
 - Family members, roommates, consensual sex partners, etc...
- Types of references to submit:
 - Buccal swabs
 - Whole blood sample (**purple** top tubes)
 - If victim is missing: toothbrush, hair brush, razor, etc...
 - If a Missing Person case then submit the completed DNA Consent forms along with family members reference sample
- Submit probative evidence **not** all evidence
- If sexual assault: provide full kits including victim/suspect intimate items (panties, clothing, probative items, etc)

WHAT HAPPENS IF YOU DON'T HAVE A SUBJECT?

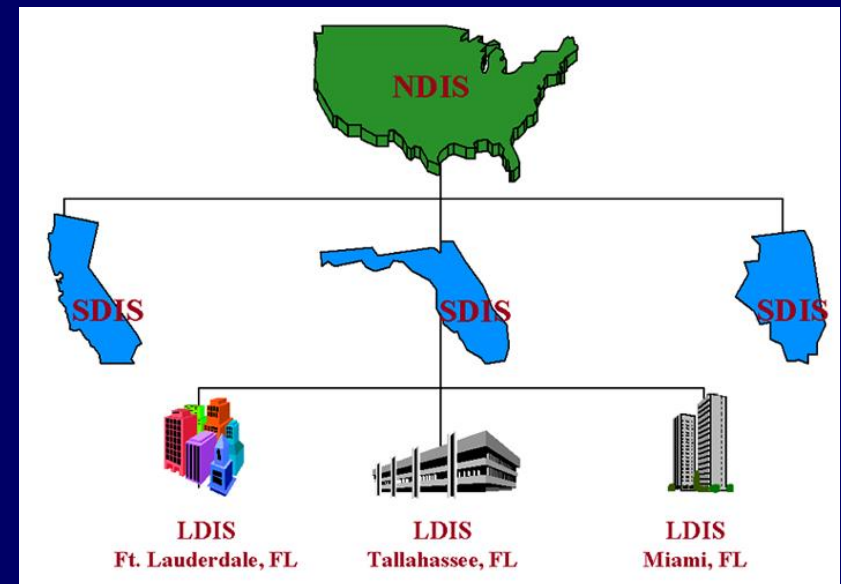
- Evidentiary **nuclear DNA** profiles may be entered into CODIS (the Combined DNA Index System)
 - ONLY if items **are** CODIS eligible
THE ITEMS HAVE TO BE ASSOCIATED WITH A CRIME!
 - Reference samples **ARE NOT** eligible for CODIS
 - mtDNA and Y-chromosome data **ARE NOT** searchable at CODIS except in Missing Person cases
- The quality/quantity of the STR profile will determine if and at what level (i.e. at the national or state level) the profile will be searched .
- If a subject becomes available submit a reference sample
 - This will speed up the process



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COMBINED DNA INDEX SYSTEM

- Software designed to connect law enforcement through exchange and comparison of DNA profiles
- National DNA database is three tiers
 - *Local level (LDIS)*
 - *State level (SDIS)*
 - *National level (NDIS)*

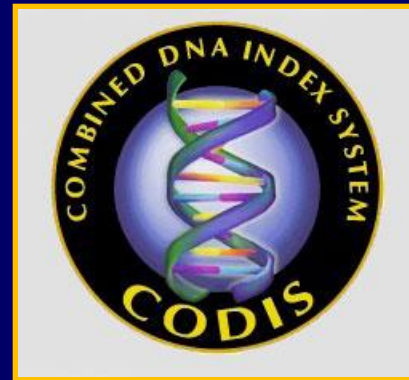


- LDIS and SDIS maintained by each local or state laboratory
- NDIS maintained by the FBI Laboratory

COMBINED DNA INDEX SYSTEM

- All three levels contain information categorized into indexes

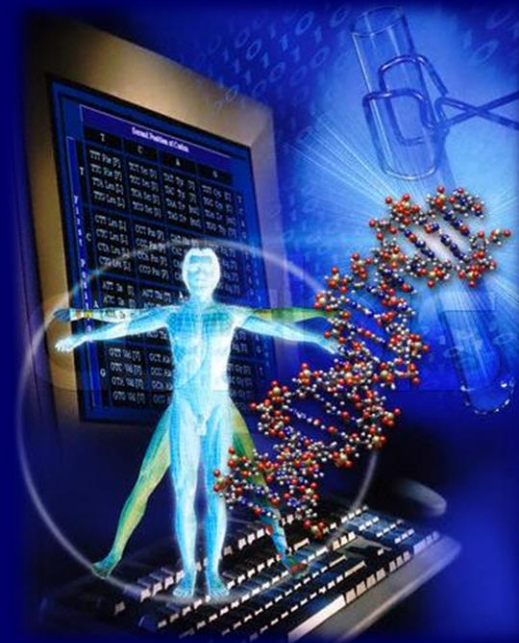
- *Offender*
- *Forensic*
- *Missing persons*



- Connect serial crimes committed by repeat offenders
- Locate suspects not initially identified through comparison
- Link unidentified human remains to a missing person

CODIS REGULATIONS

- Legislation determines the samples permitted into CODIS
- No personal, criminal, or case-related information is contained within CODIS
- Protection of the innocent is paramount
 - Documentation must indicate a crime was committed
 - Documentation must indicate evidence as from scene
 - Items collected from the suspect's person are excluded
- New sample from the suspect must be collected for comparison purposes upon CODIS hit





Please contact the DNA Casework Unit at
(703) 632-8446 if you have any questions

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